111 (1). Carposina, H.-S.

912 (1). *Carposina berberidella*, H.-S.

Carposina berberidella, Stgr. & Wk. Cat. Lp. Eur. 304. No. 2186 (1871).

Hab. Europe. Asiatic Turkey—*Haleb*—Shar Devesy (*Native Coll.* 1890).

[To be continued.]

LXIV.—*On the Squirrels of the* Ratufa (Sciurus) bicolor *Group.* By J. Lewis Bonhote.

In writing another paper dealing with various subspecies of squirrels, I should like to make a few remarks on what appear to me the advantages and necessity of recognizing these subspecific differences.

In former days, when a few skins roughly labelled and undated were the only material with which the systematist had to work, he was of necessity compelled to place under one name the various nearly allied forms which came into his hands; many of them had been described by the collector, who on getting a specimen he had not before seen, straightway described it, having no means at hand of ascertaining whether it had been previously named or not, and possibly not realizing the confusion he was storing up for the workers of the next generation. Gradually, then, as these types accumulated in large museums and were compared with each other—isolated specimens from isolated localities—the first obvious inference was that they all belonged to one species, and under one name they were accordingly placed, forms showing the most striking differences being allowed to rank as separate species. Of late years, however, large series carefully collected and with full data have been received, from which we are able to see that many of these old types referred to above are typical examples of well-defined races constant to themselves and the localities from which they come. To call these races species is misleading, as their points of difference are not sufficiently great for specific characters, and most of them would probably, if placed under conditions identical with those of another race, lose in a few generations their own characteristics and assume those of the race into whose territory they had been imported *.

What, then, should we do? Are we to ignore these differences altogether? That could hardly be done without acknowledging our incompetence as systematists, besides which it should be borne in mind that many of these forms are in reality incipient species, and, in time to come, to have them all carefully described and enumerated will surely throw considerable light on the causes affecting variation, the period required to fix a variety, and questions such as these, about which at present we know hardly the rudimental facts, owing to our absolute lack of reliable descriptions and data of specimens collected so recently as fifty or sixty years ago.

It seems to me therefore that such forms should be noticed wherever they occur, and the chief question is, in what manner should they be designated? This at once leads us to the vexed question of trinomials, which subject I have neither the ability or knowledge to dilate upon: personally I use trinomials, as being the shortest, simplest, and most concise way of dealing with varieties due to geographical or climatic causes; it is used with great success by Americans, who in the study and classification of mammals are certainly ahead of the naturalists of most countries.

As Mr. Blanford remarks in his paper on *Sciurus indicus* †, trinomials are doubtless used for variations induced by many other causes; but one reason I would venture to put forward for the restriction of trinomials to geographical or climatic races is that when these forms become sufficiently differentiated to be regarded as *true* species no change of nomenclature need be made.

The evolution of the species must of necessity be a slow process, and a stage of evolution must sooner or later be reached in which the characteristics which would entitle it to specific rank will become very precarious and opinions will differ as to its correct designation, some authorities calling it a variety of a well-known species, while others will give it a specific name, and confusion is bound to result. Admit trinomials, and he who considers it a species will simply omit the second name, but the third name will be that by which it is known whether as species or subspecies.

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* This has been proved by experiment (chiefly with regard to hot and cold forms) with insects, and possibly similar results, though hardly as striking, could be arrived at with squirrels; the subject is one which it would be impossible to demonstrate by actual experiment—it might take two generations or it might take thirty. One is, however, justified in judging by analogy.

† Journ. Bombay N. H. Soc. vol. xi. p. 300.

My attention having been called to this group while working on some specimens from Siam, I have gone carefully through the large series in the British Museum, with the following results.

These squirrels may be readily divided into four distinct species and several subspecies or geographical races. The true habitat of all these forms is clearly defined, though from lack of material the exact limits of their range in one or two cases is still doubtful.

The species are as follows:—

(1) *Ratufa* * *gigantea*.—Ranging from the Himalayas, Nepal, and Sikkim to Siam and the Malay Peninsula.
(2) *Ratufa bicolor*.—From Java, Sumatra, the Malay Peninsula, and probably Borneo.
(3) *Ratufa affinis*.—Inhabiting the southern portion of the Malay Peninsula.
(4) *Ratufa ephippium*.—From Borneo and the Natunas.

The study of the group has been much confused by a great mass of names, a large proportion of which belong to one species, viz. *R. bicolor*, which varies so much, owing to a total or partial bleaching of its hairs, as to present considerable differences. It is worthy of note that this so-called bleaching † process does not take place in all the species; in *R. gigantea*, for instance, it is absent, although it occurs in *R. bicolor*, which overlaps the range of its larger congener in Malacca. In *R. bicolor* the bleaching is chiefly confined to the body, rarely extending to the limbs, although hardly any two individuals are exactly alike; in *R. affinis*, *aureiventer*, *bunguranensis*, and *nanogigas* it is complete, covering all the upper parts of the body, while in *R. ephippium* it is almost entirely absent, or, if taking place at all, is confined to the tail.

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* For use of the generic name *Ratufa* see Thos., P. Z. S. 1897, p. 933.

† I have called this process "bleaching," as that was the term used by Mr. Oldfield Thomas (Zool. 1896, p. 401) when describing a similar process in our British squirrel. In default of further knowledge it is perhaps a convenient term to use; but by employing it I do not necessarily imply that the hair is worn or faded, but merely that it changes in colour to a light yellowish brown. The causes of this change are not known, but Mr. Thomas points out that it is *not* due to the special action of the summer sun.

[I certainly meant (and still think) that the change was a true bleaching or fading, due to the action of light. In the case I was discussing, the bleaching was already produced by the light of winter and spring, without waiting for the action of the summer sun.—O. T.]

Ratufa gigantea (MacCl.).

Sciurus giganteus *, MacClelland, P. Z. S. 1839, p. 150 Anderson, An. Zool. Res. p. 215 (1879).
Sciurus macruroides, Hodgson, J. A. S. B. x. 1841, p. 915 (no description); Jerdon, Mamm. Ind. p. 168 (1867).
Sciurus bicolor, Sparr., Blanford, Faun. Brit. Ind., Mamm. p. 373 (1891).
Sciurus bicolor, var. *giganteus* (MacCl.), W. Sclater, Cat. Mamm. Ind. Mus. p. 8 (1891).

General colour above, including head and outer side of limbs, dark black, below yellow varying in intensity. Tail same colour as the back throughout. The skull is large and broad, the pterygoids and basioccipital processes being large and well developed; the latter turn inwards away from the bulla and end in a rounded head.

Dimensions (in flesh):—

Head and body 417 millim.; tail 477; ear 30; hind foot 82.

Skull: greatest length 80; basal length 62; zygomatic breadth 48·7; greatest length of nasals 24; length of palate to henselion 29.

Ratufa bicolor (Sparrm.).

Sciurus bicolor, Sparrman, Götheb. Vet. Svensk. Handl. i. p. 70 (1778); Thos. P. Z. S. 1886, p. 67; Anderson, An. Zool. Res. p. 215 (1879); Blanford, Faun. Brit. Ind., Mamm. p. 373 (1891).
Sciurus bicolor, var. *typicus*, W. Sclater, Cat. Mamm. Ind. Mus. p. 7 (1891).
Sciurus javensis, Zimm. Geog. Ges. ii. p. 342 (1780).
Sciurus albiceps, Desm. Nouv. Dict. Hist. Nat. x. p. 105 (1817).
Sciurus Leschenaulti, Desm. Mamm. p. 335 (1820).
Sciurus hypoleucos, Horsf. Zool. Res. (1824).
Sciurus humeralis, Coulon, Mém. Soc. Sc. Nat. Neuchâtel (1835).

Smaller and paler than the preceding species and much lighter across the back. General colour above dark brown, considerably bleached across the centre of the back, but varying greatly in shade, some specimens being nearly black. Colour of underparts and tail as in the preceding species. Ears never tufted. Skull shows no marked differences from that of *R. gigantea* except in its smaller size.

Dimensions:—

Skull: greatest length 71·5 millim.; basal length 57; zygomatic breadth 45; greatest length of nasals 22; length of palate to henselion 27.

With regard to the smaller size of this species, it is as well to give the limits of variation, so as to show how easily it may be distinguished by size alone, which is the chief point of difference between this and the preceding species.

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* For full synonymy of this and the next species see Anderson and W. Sclater as quoted above.

The limits are as follows :—

	Greatest length. mm.	Basal length. mm.	Zygomatic breadth. mm.	Length of nasals. mm.	Length of palate to henselion. mm.
R. gigantea.	80—77	62—61	48·7—47·5	26—24·5	31—30
R. bicolor . .	71·5*	57*	45—44·5	22—19·5	29—27

Almost every specimen of the present form is lighter in colour than its larger relative; but there is no doubt that this colour is due to the "bleaching" process referred to above.

This species is by far the most variable of the group, and has in consequence received many names. I have carefully gone over all the original descriptions of the names given in the above synonymy, and am convinced that they all refer to one and the same species.

With regard to the limits of its distribution there exists some doubt; it is certainly commonest in Java and Sumatra, and probably occurs in Borneo. The Museum possesses two specimens labelled N.W. Borneo, which were procured by Mr. Waterstraat; they are both alike, but differ slightly from examples from the other islands; and there is also an old skeleton labelled Borneo, the skull of which agrees perfectly with Javan examples. On the other hand, should this species occur in Borneo it is strange that neither Mr. Hose nor Mr. Everett ever came across it. It seems to me that the balance of evidence is in favour of its being found there, but a few more thoroughly authenticated specimens are required before pronouncing a definite opinion. The other locality where its occurrence may be considered somewhat doubtful is in the Malay Peninsula. The Museum contains two specimens from Bankasun, collected by Mr. W. Davison, which, except in being slightly darker, agree in all respects with Javan examples. Mr. Davison was such a careful collector that there can be no doubt that the data given are correct; it must therefore overlap the range of its larger ally, specimens of which have been got far to the south in the Malay Peninsula; Mr. Blanford, moreover, describes this species (as a variety of *R. gigantea*) from the "Irrawady delta and perhaps Martaban and Tenasserim." It probably occupies the low-lying land in the Malay Peninsula, while *R. gigantea* occupies the hills.

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* Owing to the skulls being imperfect only one measurement was taken.

The remaining species can be easily distinguished from the foregoing by certain well-marked characters. They are all slightly smaller than *R. bicolor*. The tail is markedly distichous and its hairs light at their bases. The skull is narrower in proportion to its length and the supraorbital processes well developed; the basioccipital processes are small and laterally flattened, they hardly bend inwards, and do not end in a knob as in the larger species. Except in size, the skulls of this latter group do not differ much among themselves.

Ratufa affinis typica (Raffles).

Sciurus affinis, Raffles (nec Horsf.), Linn. Trans. xiii. 1822, p. 259.

General colour above, including head and outside of feet, light brown or "café-au-lait," bleaching to light yellow, each hair when newly grown having a faint subterminal annulation of yellowish. Underparts pure white.

Dimensions (from skin):—

Head and body 330 millim.; tail 375; hind foot 70.

Skull: zygomatic breadth 39; greatest length of nasals 20; length of palate from henselion 25.

Hab. Singapore and Johore.

Raffles's description, which agrees closely with several specimens in the Museum from Johore, was made from a specimen from Singapore collected by M. Diard, when writing a paper on some of the latter's specimens from Sumatra. This is further evidence that the true locality of *R. affinis aureiventer*, the next species, is Malacca.

Ratufa affinis aureiventer (Geoffr.).

Sciurus aureiventer, Is. Geoffr., Guérin, Mag. Zool. 1832; Is. Geoffr. Voy. Ind.-Orient. Bélanger, p. 150 (1834); Coulon, Mém. de la Soc. Sc. Nat. de Neuchâtel, vol. i. 1835, p. 123, pl. ix.

Resembles the foregoing in all points, but is slightly smaller and the underparts are of a yellowish orange.

Dimensions (from skin):—

Head and body 336 millim.; tail 400; hind foot 70.

Skull: greatest breadth 40; greatest length of nasals 18·2; length of palate to henselion 27.

Hab. Described from Java. All specimens in the Museum come from the Malay Peninsula from Penang to Malacca. It does not apparently overlap the preceding form.

This species was named from a specimen collected by M. Diard in Java; the plate, however, agrees so exactly with specimens in the Museum from Malacca that there is little doubt it represents the same animal. M. Diard also collected in the Malay Peninsula, so it is quite possible that the type specimen may have come from Malacca and have been wrongly labelled; it may occur in Java, but I can find no record to that effect beyond the original description. It is stated in the key at the end of this paper that this species has light subterminal annulations to each of the hairs; the bleaching process, however, goes on so quickly in this species that these annulations are only visible in freshly grown hairs. This squirrel is so distinct in coloration that there can be no difficulty in identifying it by the colour alone.

Ratufa ephippium typica (Müll.).

Sciurus ephippium, Müller, Tijdschr. voor Nat. Gesch. 1839, p. 147; Müller and Schlegel, Verhandl. Nat. Gesch. 1843, pp. 86 & 91, pl. xiii.

This form is chiefly noticeable for the purity of its colouring, very few of the hairs having subterminal annulations. From the top of the head to the root of the tail runs a broad and very dark brown stripe, slightly lighter over the shoulders owing to annulations on the hairs, and spreading out in a similar manner over the posterior part of the body; remainder of the flanks, sides of the neck, face, and ears ferruginous, fading into pale orange on the limbs, feet, and throat, being palest on the forehead. Underparts yellowish white. Tail dark brown.

Dimensions (as given by Müller):—

Head and body 350 millim.; tail 400.

Skull (from Museum specimen): greatest length 65; zygomatic breadth 42; greatest length of nasals 20; length of palate from henselion 26.

Hab. Great Dyak River, S.E. Borneo.

It is to be noticed that in this species the tail bleaches to a dirty creamy white.

Ratufa ephippium baramensis, subsp. n.

Sciurus ephippium, Wagner, Schreber, Säugeth. Suppl. vol. iii. 1843, p. 193; Hose, Mamm. Borneo, 1893, p. 44.
Sciurus bicolor ephippium, Thos. P. Z. S. 1892, p. 225.

General colour above dark brown, each hair having a rufous subterminal annulation. Along the centre of the back, especially on the posterior half, there are no annulations, a dark median stripe being thus formed. Underparts, including outside of fore limbs and feet, deep yellow, becoming ferruginous on the cheeks. Tail uniform dark brown.

Dimensions of type (from skin):—

Head and body 400 millim.; tail 450; hind foot 70.

Skull: greatest length 67; basal length 52·2; length of nasals 19; length of palate to henselion 26·2.

Hab. Baram District, Sarawak.

Type B.M. 99. 12. 9. 40. ♂, Baram District, Sarawak, 15th June, 1898. Presented by Charles Hose, Esq.

This form seems subject to many slight local variations. Mr. Hose informs me that those found on the hills are ruddier on the cheeks than those from the low-lying country, and the tail has a tendency to be ringed with rufous caused by subterminal annulations to certain of the hairs.

Ratufa ephippium sandakanensis, subsp. n.

Sciurus bicolor ephippium, Thos. P. Z. S. 1889, p. 230.
Sciurus ephippium, Motley and Dillwyn, Contrib. Fauna Borneo and Labuan, 1855, p. 3.

Resembling *R. ephippium baramensis*, but the hairs on the back black, *not* brown, with yellowish-white subterminal annulations instead of rufous. These annulations are absent along the centre of the back, thus forming a dark median dorsal stripe which starts between the shoulders and runs to the root of the tail. The feet, inner sides of limbs, and underparts are of a dirty yellowish white, and on the cheeks is a small patch of ferruginous.

Dimensions of type (from flesh):—

Head and body 350 millim.; tail 540; hind foot 74.

Skull: greatest length 68; basal length 54; zygomatic breadth 42; length of nasals 20; length of palate from henselion 26.

Hab. Sandakan, British North Borneo.

Type B.M. 82. 11. 16. 3. Sandakan, British North Borneo. Presented by Mr. Arch. McKinlay.

The Museum possesses several other specimens of this form, all from North Borneo; they differ slightly from the type in having the head, neck, and feet more rufous, which is probably due to altitude, as noticed in the preceding species.

Ratufa ephippium bunguranensis (Thos. & Hart).

Sciurus ephippium bunguranensis, Thos. & Hart, Nov. Zool. i., Sept. 1894, p. 658.

This and the two remaining species are all very closely allied and are island forms of the typical mainland race. They are characterized by their duller colour and the absence of the dark median dorsal area, all the hairs on the upper surface being uniformly annulated. The present species is of a light chocolate-brown above ("Prout's brown" of Ridgway, as it is styled in the original description). Underparts deep ferruginous; feet black.

Dimensions (from skin):—

Head and body 350 millim.; tail 420; hind foot 63.

Skull: greatest length 63; basal length 50; zygomatic breadth 39; greatest length of nasals 19·4; length of palate to henselion 27·5.

Hab. Island of Bunguran, Natuna Group.

This species, in common with the two succeeding forms, bleaches to a great extent, giving rise to many varieties.

Ratufa ephippium nanogigas (Thos. & Hart).

Sciurus ephippium nanogigas, Thos. & Hart, Nov. Zool. ii., Dec. 1895, p. 491.

Resembles *R. eph. bunguranensis* very closely except as regards size. The underparts also are much lighter in colour, being light yellow.

Dimensions (from skin):—

Head and body 330 millim.; tail 347; hind foot 60.

Skull: greatest length 47·5 millim.; basal length 43; zygomatic breadth 34; greatest length of nasals 16; length of palate from henselion 21.

Hab. Pulau Laut, N. Natunas.

Ratufa ephippium sirhassenensis, subsp. n.

Sciurus ephippium albiceps, Thos. & Hart, Nov. Zool. i., Sept. 1894, p. 659.

Allied to the *bunguranensis-nanogigas* group and intermediate in size between the two. In the general coloration it resembles the smaller of the two (*nanogigas*), but differs from that species in the light annulations to the hairs being broader and lighter, while the ears, sides of the face, and outer sides of the limbs are of the same colour as the underparts, viz. light yellow, instead of black, as in *nanogigas*.

Dimensions (from skin):—

Head and body 340 millim.; tail 410; hind foot 60.

Skull: zygomatic breadth 37; greatest length of nasals 18; length of palate from henselion 23·5.

Hab. Sirhassen Island, Natuna Group.

Type B.M. 94. 9. 28. 13. Sirhassen, 23rd Sept., 1893. Collected by Mr. A. Everett.

Key to Species.

Tail not markedly distichous, its hairs dark at their bases.	
Large; colour above deep black	*R. gigantea.*
Smaller; colour above lightish, especially across the centre of the back	*R. bicolor.*
Tail markedly distichous, with light bases to the hairs.	
All the hairs on the back with light subterminal annulations.	
Feet light.	
Colour of upperside "café-au-lait."	
Belly yellowish orange	*R. affinis aureiventer.*
Belly white	*R. affinis typicus.*
Colour of upperside uniform grizzled amber-brown	*R. ephippium sirhassenensis.*
Feet black.	
Large; underparts deep orange	*R. eph. bunguranensis.*
Smaller; underparts yellow	*R. eph. nanogigas.*
Hairs along the centre of back without annulations, forming dark medio-dorsal tract.	
Hairs on the sides of body with annulations.	
General colour grey	*R. eph. sandakanensis.*
General colour brown	*R. eph. baramensis.*
Hairs on the sides of the body without annulations, especially anteriorly.	
Colour of flanks deep rufous.	*R. eph. typica.*

LXV.—*A new Skunk from Peru.*

By OLDFIELD THOMAS.

Conepatus inca, sp. n.

Size medium. Fur long, coarse, and close; underfur abundant. White markings much reduced, consisting only of a narrow ($\frac{1}{4}$ to $\frac{3}{4}$ inch wide) band on each side, joined on the occiput and running back only as far as the shoulders, or at most to middle of the back, where they come to an end. Tail black, an intermixture of white hairs at its tip.

Skull proportions as shown by the measurements below. Zygomata less widely expanded than in *C. mapurito*. Last upper molar decidedly larger than in *C. zorilla*.

Dimensions of the type (an adult female, measured by collector in the flesh):—

Head and body 350 millim.; tail 210; hind foot (s. u.) 65; ear 28.

Skull: greatest length in middle line 75·5; basal length 66·4; greatest breadth 44; intertemporal breadth 20; greatest posterior breadth 38; palate length from gnathion 32·4;